

PATENT
Docket GE126465

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SEP 03 2005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:
M. McMasters

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)
) Art Unit: 3746
)

Application No.: 10/659,145
Confirmation No: 3043

)
) Examiner: Kim, T.
)

Filed: 09/10/2003

Title: Thick Coated Combustor Liner

DECLARATION UNDER 37 CFR 1.131

1. MPEP 715 addresses swearing back of a reference, and cites 37 CFR 1.131 that provides in part:

(a) When any claim of an application ... is rejected, the inventor of the subject matter of the rejected claim ... may submit an appropriate oath or declaration to establish invention of the subject matter of the rejected claim prior to the effective date of the reference ... on which the rejection is based....

(b) The showing of facts shall be such, in character and weight, as to establish reduction to practice prior to the effective date of the reference, or conception of the invention prior to the effective date of the reference coupled with due diligence from prior to said date to a subsequent reduction to practice or to the filing of the application. Original exhibits of drawings or records, or photocopies thereof, must accompany and form part of the affidavit or declaration or their absence satisfactorily explained..

2. MPEP 715.07 addresses facts and documentary evidence and states that:

... Conception is the mental part of the inventive act, but it must be capable of proof, as by drawings, complete disclosure to another person, etc....

In general, proof of actual reduction to practice requires a showing that the apparatus actually existed and worked for its intended purpose. However, "there are some devices so simple that a mere construction of them is all that is necessary to constitute reduction to practice."

3. This Declaration under Rule 131 is being presented for

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antedating U.S. Patent Application Publication US 2003/0200752A1, entitled " Multihole Patch for Combustor Liner of a Gas Turbine Engine," by G.E. Moertle et al, having a publication date of 10/30/2003, and a filing date of 04/29/2002.

4. I, Marie Ann McMasters, am the sole inventor of the subject matter described and claimed in the above identified subject patent application entitled "Thick Coated Combustor Liner," hereinbelow referred to as the "subject invention." And, I hereby declare the following:
5. The subject invention was invented by me during my employment as a Senior Staff Engineer and program manager for mechanical design for the GE Aircraft Engines division of General Electric Company in Evendale, Ohio.
6. Attached to this Declaration is a copy of the Invention Disclosure (GT85) that I prepared in the ordinary course of business for GE Aircraft Engines to document the subject invention, which document was signed by me as indicated on 5/8/02, and witnessed by two witnesses who also signed the document on 5/8/02 and 7/26/02, respectively. Note that my Social Security Number has been redacted to maintain personal privacy. This invention disclosure was docketed and assigned docket number 126465 on or about 06/21/02 by the GE patent legal office in Evendale, Ohio, as also indicated on the document.
7. In my role as program manager, I managed a specific program to develop an improved combustor, known as the CFM TAPS product design, for use in an aircraft gas turbine engine, as identified in section 3.4(h) of the invention disclosure. This CFM TAPS development program began in 1999, and continues to the present day.

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8. The CFM TAPS development program includes many additional employees of the GE company; is an elaborate and lengthy process that follows a specified development schedule over time in the ordinary course of business for aircraft gas turbine engines; and requires suitable testing of the combustor design and approval thereof by GE Aircraft Engines, and which combustor design will also require certification by the Federal Aviation Administration (FAA) of the U.S. Government for subsequent commercial aircraft use.
9. The invention disclosure documents in section 3.3 thereof that I conceived the subject invention on or about May 2001; and that the subject invention was first built on or about November 2001 during the course of the CFM TAPS program.
10. The invention disclosure describes the subject invention in sections 1.4 and 1.5; illustrates two embodiments of the subject invention in figures 1 and 2, which correspond with Figures 3 and 4, respectively in the subject patent application; and depicts performance thereof in the two graphs.
11. The CFM TAPS combustor includes several builds during the development program. The second build, and subsequent builds, included the subject invention; with the combustor liners thereof being made in-house at the GE Aircraft Engines plant, in Evendale, Ohio; and the thick thermal barrier coating (TBC) was applied to the liners by the vendor Praxair, located in Indiana, and identified in section 3.4(h) of the invention disclosure.
12. The invention disclosure further indicates in section 3.4(h) that the combustor liners sprayed with the TBC for the CFM TAPS combustor were documented in drawings 4013482-577G01AB and 4013482-589G01AB for the outer and inner liners, and conform with both figures 1 and 2 of the invention

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disclosure.

13. The invention disclosure indicates in sections 3.3 and 3.4(h) the requirement for endurance testing for a combustor including the subject invention prior to incorporation of the subject invention into the intended CFM TAPS product design.
14. Prior to conducting that endurance testing, the CFM TAPS combustor was evaluated for efficiency performance in preliminary testing conducted at GE in the Evendale, Ohio plant, which included a first build of the combustor, without the subject invention, and a first efficiency test conducted in early 2001; a second build of the combustor, in which the subject invention was introduced into the CFM TAPS combustor design, and a second efficiency test conducted in early 2002; followed by another build and another efficiency test conducted in early 2003, which preliminary testing occurred during the ordinary course of business and in accordance with the development schedule.
15. Attached to this Declaration is the cover sheet for the Post-Test Summary of the second CFM TAPS build (ESN 105-101/2), dated 02/06/02, which documents the results of the second efficiency test.
16. Following successful completion of the efficiency testing, another build of the combustor, including the subject invention, was then submitted to an endurance test conducted in Belgium by the partner company SNECMA during March and April, 2003, with the tested combustor then being shipped back to GE Aircraft Engines, Evendale, Ohio, and received on or about August 2003.
17. The endurance-tested combustor was then evaluated and inspected by GE employees, including myself, and found to have successfully completed the endurance test.

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18. The subject invention having successfully passed the endurance test was then approved by GE Aircraft Engines for use in the CFM TAPS product design found in the drawings identified in para. 12 above.
19. Attached to this Declaration is a copy of the cover sheet for the CFM TAPS Endurance Engine Combustor Post Test Review, dated 9-29-03, which documents successful completion of the endurance test by the combustor including the subject invention.
20. The subject patent application was filed in the USPTO on 09/10/2003 contemporaneous with the successful conclusion of the endurance test of the combustor including the subject invention.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Marie Ann McMasters

Marie Ann McMasters


9/3/05

Date

Attachments:

1. Invention Disclosure (GT85) for Docket Number 126465 (5 pages)
2. Post-Test Summary, CFM56-7B/2, ESN 105-101/2, single page cover sheet
3. CFM TAPS Endurance Engine Combustor Post Test Review, single page cover sheet

SEP 03 2005

To: <u>USA</u> V.G. Ramaswamy Patent Attorney H17, Evendale	 GE Aircraft Engines Invention Disclosure General Electric Company	For Legal Operation Use Docket Number <u>12-6465</u> Date Opened <u>6/21/02</u> By <u>K. Howard</u>
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- 1.0 DESCRIPTION OF THE INVENTION:** Prepare and attach a brief written description, sufficient to inform the Patent Evaluation Board (generally knowledgeable in the subject matter) of your invention. Please use the outline/instructions provided below to complete the form following page 3. After a Docket Number is assigned to the written submittal, an electronic copy of this disclosure will be requested.
- 1.1 Title:** Provide a title that is descriptive of your invention.
- 1.2 Statement of the Problem:** What need does your invention address? Briefly describe the problem or requirement addressed by your invention.
- 1.3 State of The Art:** How has the need been addressed before? Briefly describe how the problem was addressed prior to your invention. List any relevant literature or patents of which you are aware.
- 1.4 Description and Operation:** How does your invention work? Briefly describe the important features of your invention and explain how to use the invention to solve the problem. Attach pictures, e.g., drawings, sketches, graph, flow charts, photographs, to help illustrate the invention. Label the pictures with reference numerals and refer to the numerals in your written description.
- 1.5 Results:** What advantages are provided by your invention? Briefly describe any efforts to make a prototype of your invention or to test your invention. Summarize the results of any related experiments and testing and highlight any results of particular significance.
- 1.6 Execution:** Using the format illustrated below,
 (i) Each submitter must sign and date each page of the Description of the Invention and each sheet of any pictures provided as part of the disclosure.
 (ii) Two witnesses must read, understand, sign and date each page of the Description of the Invention and each sheet of any pictures provided as part of the disclosure.

Submitted By:			
Marie McMasters	5-6-02		
Inventor's signature	Date		
<u>Marie McMasters</u>	<u>5/8/02</u>	<u>D. Douglas Thomas</u>	<u>5/8/02</u>
Inventor's signature	Date	Witness's Signature	Date
		<u>Raghavun P. Pandey</u>	<u>7-26-02</u>
Inventor's signature	Date		

2.0 Inventor Information: Provide the following information for each inventor. Please note, the term "inventor" is not used here in a rigorous sense and, ultimately, identification of the proper inventors of an invention is a legal determination based on the claims of the patent application as filed. Use page 1a if needed.

Print or Type	Lead Inventor	Inventor	Inventor
Full Name (including middle)	Marie Ann McMasters		
Social Security Number			
Home Address	6954 Owlwood Dr. Mason, Ohio 45040		
Citizenship	USA		
Mail Drop	E404		
Work Telephone Number	243-5959		
Department and Occupation	AEPD, Staff Engineer, Advanced Combustion Engineering		

GE PROPRIETARY INFORMATION

GT185(6/01)

Page 1 of 2

1.0 DESCRIPTION OF THE INVENTION:**1.1 Title.**

Thick TBC Taper for Improved Film Effectiveness

1.2 Statement of the Problem:

As the engine operating conditions increase and the liner cooling flow decreases for lower NOx emissions, thicker TBC is required to protect the substrate. Using the current machined ring liner slot exit geometry, just adding the TBC without regard for cooling effectiveness could lead to inadequate cooling or a metering of the flow across the slot exit rather than the cooling holes.

1.3 State of The Art:

The film effectiveness was investigated for several cooling slot overhang geometries, which included variations in TBC thickness and TBC taper angle, to determine the best configuration for the thicker TBC. The TBC must be applied at a certain distance from the overhang end and at a certain angle depending upon whether the cooling holes are drilled axially or radially.

1.4 Description and Operation:

For axially drilled cooling holes, the TBC taper must be at a 45° angle (Figure 1) with the taper starting ~ .030" from the slot end. For radially drilled cooling holes, the TBC taper must be at an 85° angle (Figure 2) with the taper starting ~ .030" from the slot end. This geometry maximizes the cooling effectiveness with the thicker TBC.

1.5 Results:

For typical combustor liners the X/S = between 9 and 15. The M ratio is usually around .5 but can go as high as 1. For the M ratio = .5, the configuration 12 has the best result which is the radial cooling injection with the 85° TBC angle. The first nugget of a machined ring liner is axial injection to provide better starting film. For the M ratio = 1, configuration 2 was best for axial injection.

Marie McMaster
5/8/02

N. D. Thompson
5/8/02

Marie McMastersThick TBC Taper for Improved Film Effectiveness

Name of Inventor Completing Form

Title of Invention

(A SEPARATE COPY OF THIS PAGE MUST BE SUBMITTED BY EACH INVENTOR.)

3.0 OTHER INFORMATION3.1 Have you signed an "Employee Innovation & Proprietary Information Agreement"? Yes ☒ No ☐3.2 **Product.** Indicate the specific engine, equipment, or apparatus to which your invention pertains:
Any commercial or military combustor liner with thick TBC.3.3 **EACH NAMED INVENTOR MUST FURNISH** the information requested below so that a determination can be made on whether the invention is reportable to the Government.

	Conception	First Built	Tested
Documented Date	5/01	11/01	Endurance testing in process
DAN No. (or overhead)	CXMRS	CXMRS	CXMRS
Was this work done under Government Contract?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes - Contract Number*			

* Briefly describe the activity:

3.4 Information Regarding Disclosure and Use of the invention

- | | YES | NO |
|--|-------------------------------------|-------------------------------------|
| (a) Has the invention been disclosed to anyone other than employees of GE (for example, vendor or a potential customer)? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| (b) Has the invention been described in an electronic or printed publication? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| (c) Has the invention been demonstrated for or used by anyone other than GE employees? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| (d) Has the invention been used commercially? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| (e) Has the invention been sold or offered for sale? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| (f) Have steps been taken to commercialize the invention? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| (g) Is any disclosure, demonstration, commercial use or offer for sale of the invention planned? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

(h) If you have answered "YES" to any of questions 3.4 (a) - (g), please provide detailed information below regarding the relevant dates and circumstances. Include all part numbers and specifications that may be impacted. Attach other pages if necessary.

Praxair has sprayed the liner with the new TBC geometry. Testing results not complete yet for final validation. If endurance testing is successful, then the liner TBC geometry will become part of the CFM TAPS product design. The liners sprayed are 4013482-577G01AB, 4013482-589G01AB.

3.5 Initiatives: Check all applicable initiatives and/or designate the underlying engineering development program.
☐ Business Method ☐ E-Commerce ☐ Service ☐ Six Sigma Development Program: Tech 56
3.6 Patent Boards: (See <http://genet.ae.ge.com/ORG/LEGAL/intprop> for descriptions)

Please check the Patent Evaluation Board (business application) and Local Patent Board (technical subject area) appropriate for your invention.

Patent Evaluation Boards

- ☒ Commercial Applications (COM)
☐ Military Programs (MIL)
☐ Engine Services (GEES)
☐ Material & Process Engineering Dept. (MPED)
☐ Industrial Aero Derivative (IAD)
☐ Manufacturing & Quality Technology (M&QTD)
☐ E-Business (also LPB)
☐ Advanced Design/Development

Local Patent Boards (LPBs)

- ☐ (A) Fan Compressor
☒ (B) Combustor
☐ (C) Turbine Airfoils
☐ (D) Rotating Parts
☐ (E) Structures
☐ (F) BS&D Controls Mech Systems/Comp's
☐ (G) Fuel Systems/Components
☐ (H) Materials & Coatings
☐ (I) Manufacturing Apparatus/Processes
☐ (J) Cycles & Systems

- ☐ (K) Testing
☐ (L) Repair Technology
☐ (M) Support Equipment Tooling
☐ (O) Configurations
☐ (P) Inlets & Exhausts (Military)
☐ (Q) Advanced Programs (HSCT, JTDE)
☐ (R) Thrust Reversers, Nozzles & EBU
☐ (S) Controls & Diagnostic Systems
☐ (T) Electrical Systems/Components
☐ (V) Miscellaneous

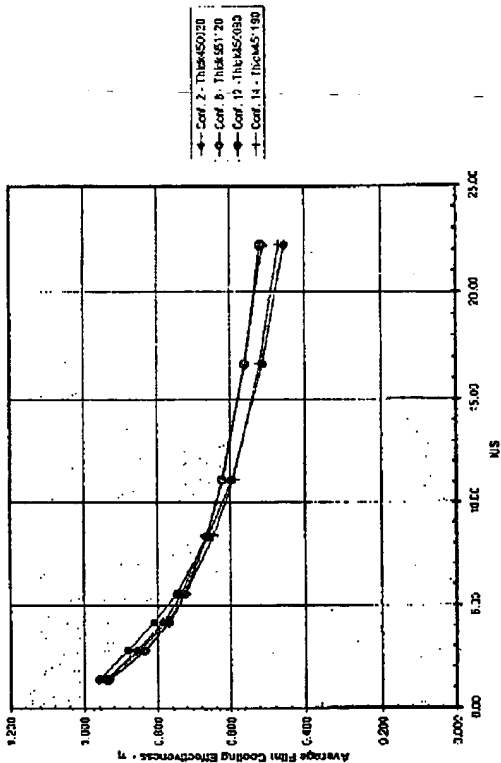
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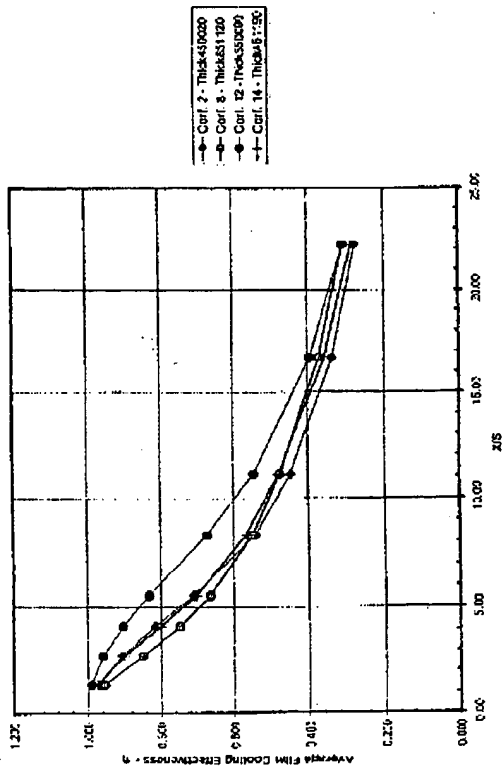
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Marie McMasters 5/18/05
D. Douglas Thomas 5/18/05
D. Douglas Thomas 7-2

Comparison of Average η Results, $m = 1.0$



Comparison of Average η Results, $m = 0.5$



Insert

Power Point Presentations/Pictures here:

To do this click anywhere on this sheet then click Insert - Object, then Click the Create from File Tab, Browse to your file and double click it, then click ok. You may then have to change the sizing on the file depending on what it is.

V. Douglas Thomas
6/18/02

Marie McMaster
6/18/02

Raghuvaran P. Prasad

7-22-02

GE PROPRIETARY INFORMATION

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GT8516:01

Figure 2

Radial injection, TBC angle @ 85deg

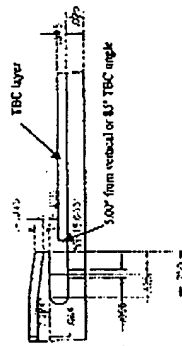


Figure 2

Enlarged for Rule 1317

Radial injection, TBC angle @ 85deg

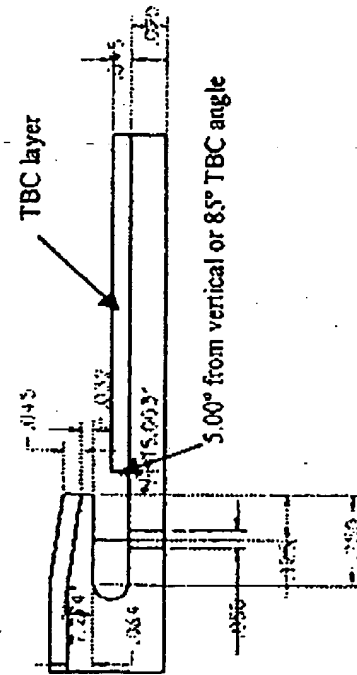


Figure 1

Axial injection, TBC angle @ 45deg

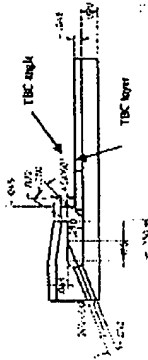
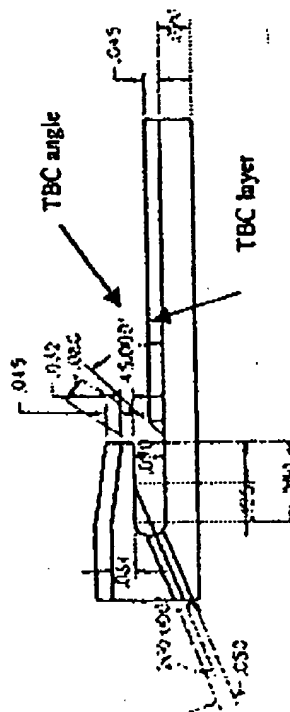


Figure 1

[Enlarged for Rule 1317]

Axial injection, TBC angle @ 45deg



D. Douglas Thomsen
Marie Nemasters 5/8/02
Rayshawna P Pandakai
7-26-02

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GT8516:0111

Project
TECH36



THE POWER
OF FLIGHT

CFM TAPS Endurance Engine Combustor Post Test Review

Marie McMasters

9-29-03

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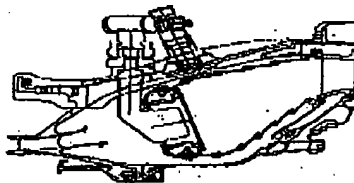
ESN 105-101/2

Test No. 3165 GEAE ETO Cell 40

CFM56-7B/2
Post-Test Summary

TITLE TAPS Phase I Combustor Demo

TECH55



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CINCINNATI, OHIO / LYNN, MASSACHUSETTS).

Approval

Nate Heathcock

N. Heathcock
Development Test Engrg.

02/06/02

Date

C. Hayes

C. Hayes
CFM56 Evaluation Engrg.

02/06/02

Date

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